Intensification of Smallholder Agriculture in Ethiopia: Options and Scenarios

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By

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Acronyms and Abbreviations

ADLI	Agricultural Development Led Industrialization
Birr	Ethiopian Currency Unit (100 cents)
DAP	Di-Ammonium Phosphate
Derg	A military Junta that administered Ethiopia between 1974 and 1991
EEA	Ethiopian Economic Association
EEA/EEPRI	Ethiopian Economic Association/Ethiopian Economic Policy Research Institute
EPRDF	Ethiopian People Revolutionary Democratic Front, A Political Party that rule Ethiopia since 1991
HA	Hectare
HH	Household
MoA	Ministry of Agriculture
MoARD	Ministry of Agriculture and Rural Development
NGO	Non-governmental Organization
Qt	Quintal (100 kilogram)
PADETES	Participatory Demonstration and Training Extension System.
RBoA	Regional Bureau of Agriculture
Urea	An inorganic fertilizer with 46% N content
WADU	Wolatia Agricultural Development Unit

1. Background

Ethiopia's inability to feed its population and thus its continued dependence on foreign donations of food to sustain millions of its citizens is a dilemma that triggers a broad economic and sociological debate. The problem of Ethiopian agriculture cannot be primarily explained by natural endowments. By any measure, Ethiopia is well endowed at least in part with a fertile soil, abundant water resources and good climatic conditions until recently. What needs careful analysis is why Ethiopian farmers continue to practice essentially the same farming methods with very little technical or management improvement for so long.

The prevailing orthodoxy among Ethiopian development practitioners, however, is largely to see the problem of smallholder agriculture in Ethiopia strictly as a technical and resource related problem. This view identifies the low level of agricultural productivity as the key problem and the solution that follows is to find ways to enhance productivity. Furthermore, productivity is essentially regarded as a technical/technological problem. Since the technology required for enhancing productivity is internationally available, what remains to be done is to widely diffuse this technology (particularly fertilizers and improved seeds) to areas with low productivity (Berhnau Nega, 2003). The government of Ethiopia has tried to implement this technology-led extension programme particularly since the mid-1990s in a high-profile national program. But has this worked, and what the limitations of such a strategy?

The national strategy chimes with a widely held view that poverty reduction in Ethiopia is impossible without significant growth in crop yields for major staples, and this requires improving farmers' access to fertiliser, improved seeds, agricultural credit and other inputs. However, this view is not new. Indeed, it has dominated development thinking for the past four decades, and some developing countries have implemented it with some success, as part of a 'green revolution'.[1] Previous Ethiopian governments have also toyed with the idea and have selectively implemented this strategy in the 1960s and 70s as part of major 'package programmes, although there was very little to show for it. But, no government in the country's history has invested so much political capital on this strategy as the current one. Not only has it accorded priority to the agriculture sector, it has made agricultural development the centrepiece of its overall development strategy. The Agriculture Development Led Industrialization strategy (ADLI) was officially formulated and inaugurated during the 1995 elections and continues to be the country's development strategy for the next five years. In fact, even before the strategy was officially launched, a massive extension program to diffuse agricultural technology (particularly fertilizers and improved seeds) was started as early as 1993/94 under the transitional government (EEA, 2002). Based on its ADLI development strategy, and drawing from the highly influential Sasakawa Global 2000 programme, the government re-vamped its national agricultural extension program, promoted a new technology package of high-yielding seeds and

[1] India, for example is a country known to have transformed its agriculture through the green revolution in the 1960s.

fertilizers to smallholder farmers, implemented major reforms of domestic input and output markets and stabilized its macro-economic environment.

This agricultural development strategy is not without criticism. There are counterarguments against this approach, with commentators pointing out that it has excessively concentrated on technology promotion. For instance, the second annual report of the Ethiopian Economic Association doubts about the exclusive concentration given to technology as a determinant of productivity in theory and the effectiveness of such a concentration in increasing productivity in practice in countries such as Ethiopia (EEA, 2002). While technology is important, the whole social structure of the accumulation process needs to be considered to effect durable productivity enhancement. The EEA report mentions the whole gamut of factors that affect decisions by farmers, including the incentive structure, institutional configuration, governance and risk behaviour patterns. These critics argue were not properly incorporated in the development programme of the government. Without such a comprehensive approach, the country's efforts at increasing productivity and transforming agriculture sector and with it bringing meaningful and sustainable development would most likely fall short the report argued (EEA, 2002).

Contrary to the experience of many countries in Asia and Latin America, agriculture-led growth strategy has not yet worked in Ethiopia. Even though the country has tried to implement 'green revolution'-like agricultural-led development strategies, success is very modest and lacks the sort of dynamism needed to bring a pattern of development that could lead to sustainable reduction of rural poverty and food insecurity. More generally, an agriculture-led growth strategy has also not brought economic transformation and help slashed poverty in most African countries (Hazell, 2005).

Ethiopia's recent experience was, however, not an entire failure. Achievements in the early years of the programme demonstrated that success is potentially possible. It was a common incident to hear of yield levels as high as 6 tones per hectare on farm land at the peak period of the government-led intensification programme (PADETES). These widely reported and advertised results demonstrated that technologies, at least when the conditions are right, are not the primary problem. Reflections on the programme have shown that institutional and policy related factors should be an integral part of any smallholder intensification programme, if sustainable impacts in terms of productivity enhancement and poverty reduction are to be brought about.

This policy paper will assess the prospects and constraints for shifting the yield frontier in grain production. The paper reviews briefly recent government experiences of the PADETES intensification programme, and its achievements in terms of improving crop yields, farm income and poverty reduction. The socio-economic conditions of small farmers and the policy and institutional environments under which the programme has been implemented will also be reviewed to identify the conditions under which agriculture-led growth can succeed in Ethiopia.

2. Recent Experience of the Smallholder Intensification Program

Ethiopia began transforming its agriculture in the mid-1990s after the EPRDF-led government formulated a development strategy centred on agriculture. The strategy which is known as the Agricultural Development Led Industrialization (ADLI) sets out agriculture as a primary stimulus to generate increased output, employment and income for the people, and as the springboard for the development of the other sectors of the economy. A 'green revolution'-like intensification of smallholder agriculture was seen as central by the government in implementing the strategy (Keeley and Scoones, 2000). Policy makers assumed that significant productivity growth could be easily achieved by improving farmers' access to technologies which would narrow the gap between farmers' yield and what agronomists called 'exploitable yield potential'. Researchers also reported the existence of technologies that can make a huge difference and shift upwards farmers' yield frontier in grain production. Based on 6 years average data, researchers (e.g. Gebrekidan et al, 2004) indicated that maize yield, for instance, can be increased from current farmers' yield level of 1.6 ton/ha to 4.7 ton/ha, and wheat from 1.1 ton/ha to 2.8 ton/ha and teff from 0.7 ton/ha to 1.5 ton/ha, if peasants use the right type and amount of improved seed varieties, fertilizers and other recommended practices.

The Ethiopian government formulated a smallholder intensification extension programme known as Participatory Agricultural Demonstration Training Extension System (PADETES) to attain this yield difference. PADETES was formulated in 1994/95 primarily based on the experience and much touted success story of Sasakawa Global 2000 program (Gebrekidan et al, 2004). The strategy was a technology-based, supply-driven intensification which consisted of enhanced supply and promotion of improved seeds, fertilizers, on-farm demonstrations of improved farm practices and technologies, improved credit supply for the purchase of inputs and close follow up of farmers' extension plots (Kassa, 2005).

Government intervention in the smallholder sector (including PADETES) was required to deal with the problem of low agricultural (especially labour and/or land) productivity, shortage of productive farm land (i.e. through enhancing land productivity), chronic rural poverty, high natural resource degradation, and a self-reinforcing situation among these problems, it was argued. This convinced not only senior technical officials in the Ministry of Agriculture, but also the Prime Minister himself. The objective of PADETES was to achieve pro-poor sustainable development in rural areas through increasing farm productivity (yield), reducing poverty and increasing the level of food security. Hence, wider dissemination of improved farm technologies, management practices and know-how to the smallholder farmers has been the major activities of the federal and regional governments in a massively expanded extension programme.

The follow sections offer an assessment of the PADETES programme's achievements and limitations over the past decade, identifying in the process some of the key constraints faced to sustainable intensification and pro-poor growth of smallholder agriculture in Ethiopia, and particularly the northern and central highlands.

Adoption of Farm Technologies

The new system has given prominent attention to the role of chemical fertilizer in ensuring food security, echoing the more recent arguments of Pedro Sanchez and Jeff Sachs as part of the MDG-focused Millennium Programme. According to ministry figures, fertilizer use grew by 39% from 190 thousand tonnes in 1994 to 264 thousand tonnes in 2003. The use of improved seeds also increased from 1,184 tonnes in 1995 to 17,778 tonnes in 1999. Similarly, during the same period, the value of farm credit rose from 8.1 million to 150.2 million Birr[2], and the number of farmers participated in the extension programme rose from 31,256 to 3,731,217 (MoA, 2003).

Despite this tremendous improvement, fertilizer use is however still very low, even compared to the African average. The promotion of improved seeds which are considered as the nucleus of any improvement is even more challenging for the extension system. For instance, only half of farmers participating in PADETES used improved seeds. Among them, 20% of early adopters discontinued their use of improved seeds immediately after their participation come to an end. In general, only 8% of sampled farmers reported their frequent use of improved seeds (see EEA forthcoming Report on Extension Study). Apart from fertilizers and improved seeds, irrigation and the use of modern farm machinery – other components of the modernization package - is almost non-existent.

Moreover, the use of different complementary inputs to the package recommended by agricultural experts is low. A recent evaluation of the smallholder intensification programme showed that only 22% of the households used complete package of crop production, i.e., improved seeds, fertilizer and improved cultural practices in the recommended amounts. Most of the households (78% who were participating in the extension package programme) used an incomplete package of crop production, lacking one or more of the major components (see EEA forthcoming Report on Extension Study).

Field studies have shown how farmers are innovating around the simple extension package provided, but the flexibility to do so is constrained by the programme. For example, in Wolayta in southern Ethiopia farmers were very keen to make use of fertilizers in their dryland outfields, but not at the rates recommended. Recalling past experiences under large Integrated Rural Development Programmes (in this case WADU), they observed that applying such amounts when rainfall is low and management limited because of other labour demands is potentially damaging to the crop and certainly uneconomic (Carswell et al, 2000; Eyasu and Scoones, 1999). This is confirmed by other studies in other parts of the country (Croppendstedt and Mamo, 1996). Instead, farmers are keen to make use of lower amounts of fertilizer through focused application which maximizes nutrient uptake to individual plants through spot application, which requires a lesser overall amount (and so cost) than blanket application as is recommended in the government package.

[2] 1 US dollar is about 8.65 Birr.

The low uptake of improved seed was also commented on by farmers in field studies. This was because the new hybrids require much more management – and significantly water management – which is not feasible on the more extensive (if small) outfields. This is dryland, opportunistic cropping where risks are high, and farmers prefer to reduce input costs as much as possible, whether of seed and fertilizer. Where there is demand for new high yielding varieties is in the home fields near the homestead which are essentially small gardens where labour, water and soil fertility inputs are high and more intensively managed. In the Wolayta setting these 'darkoa' gardens for example show high crop yields and a pattern of improving (although cyclical) soil fertility (Eyasu and Scoones, 1999). Although small in size these garden home field plots are critical to farming and livelihood strategy, and the source of a disproportionate source of crop output. For this reason, farmers are keen to invest, and will test out new technologies if they are available. Unfortunately the crop varieties often chosen as part of the package neglect such settings, where soil moisture and (organic) soil fertility is highest, as they have been bred for dryland fields and (inorganic) fertilizer inputs.

As a result, farmers who are obliged to acquire the whole package as part of the credit arrangement overseen by the government thus must dispose of some of the fertilizer and seed on the local market. This has a positive impact overall as those officially not participating in the programme (so called non-adopters in many studies) actually use the improved technologies, but with lower risks (of credit default) and in lower quantities (suited to their own needs) (Alemayehu et al, 2001)

These more local level patterns of farming practice do not appear in the generic, national-level assessments so often quoted. However, recognising patterns of farmer innovation – and the wider conditions under which technology adoption is facilitated – needs, these studies suggest, to be taken more seriously in the design and implementation of technology-led programmes aimed at agricultural intensification. Proponents of a more local-level approach, including many Ethiopia based NGOs with long experience of working on challenging agricultural problems (see, Ejigu and Waters Bayer, 2005), do not argue against new technologies per se, but for a more carefully designed 'innovation system' where the promotion of new technologies is linked to processes of farmer innovation, social and cultural institutions governing uptake, and the economic and market conditions pertaining, particularly for poorer farmers in more marginal areaas (Mitiku Haile et al, 2001).

Farm productivity and returns to technology use

While at an aggregate level grain yield has been improved by the recent smallholder intensification programme, the level of improvement is very modest especially compared to the changes in fertilizer use. While inorganic fertilizer use grew between 1989/90 and 2003/04 by 142%, grain yield increased only by 18.3%. The growth rates of total crop and cereal yields were about 0.2 and 0.6 percent per year, respectively, between 1995 and 2002. During the same period, the growth rate of total cereal production was below 2 percent per year, lower than the 2.5 percent population growth rate (Diao and Nin Pratt, 2005).

Average national yields of major cereal crops still fluctuated between 1.1 and 1.5 tonnes per hectare. There could be three potential factors that could explain this unmatched trend in technology use and grain yield. Fertilizer use might be concentrated on or expanded into soils that have poor response to increased fertilizer application or cultivation could be expanded to marginal and sloppy (hilly) areas which accelerate already widespread soil erosion in Ethiopian highlands (see above). These drops in productivity may thus act to counterbalance gains from higher potential areas. Fertilizer use might also be below the level recommended by agricultural scientists for one or another reason and not accompanied by improved seeds, a key technology upon which all other technologies including fertilizer display their full potential, although as discussed above, the difference between total fertilizer use and nutrient uptake to growing plants (the critical variable) is highly dependent on application method and setting. The third potential explanation could be the mono-cropping production pattern which can act to reduce soil fertility and deplete soil micro or secondary nutrients as well as organic structure essential for plant growth nutrients which can not be replaced by the two types of inorganic fertilizers (DAP and Urea) promoted for decades in Ethiopia.

Evaluations based on a national average grain yield, however, are as discussed above not an appropriate indicator for a country so diverse in agro-ecology and agricultural potential. National level yield can for example mask differences arising due to variations in agro-climatic zones, soil types, crop ecologies, crop types and other crop technologies. Therefore, it may be better to look the performance of major food crops that get attention in the extension programme – maize and wheat.

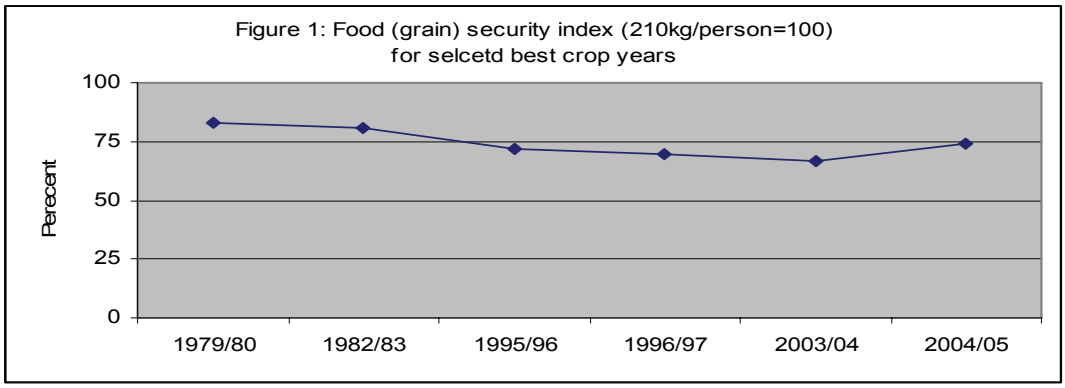
Because of the known ability of maize to respond positively to improved inputs and the possibility of achieving dramatic growth in productivity, especially given the low level of yield in the country, the extension programme had given it the highest priority. Some astonishing 'green revolution'-like progress was claimed for maize productivity, primarily in areas with good potentials in terms of rainfall, soil and infrastructure. In some areas yield levels were as high as 8 tonnes per hectare, while the national average yield for the period after 1994/95 was only 1.83 tonnes/ha. This was of course higher than the pre-1994/95 level by about 0.17 tonnes, and in that sense, maize production can be considered as a mild success story of the extension programme at a wider level.

Production and Food Security

Despite the clear drawbacks of the intensification programme, staple grain production has steadily improved in Ethiopia over the past decade. As farmers adopted new technology packages (at least partially) and the weather cooperated (which it did until 2001, and continue since 2003/04), cereal output in the last half of the 1990s averaged 10 million metric tonnes a year, 4 million more metric tons per year than in the 1980s. However, rather than technology adoption, the major factor behind this improvement is expansion of cultivated area. Between 1989/90 and 2003/04, grain production has registered a growth of 74%, with yield growing by only 18% and area cultivated by 51%. The contribution of land has even increased in recent years. Between 1994 and 2002, grain production has been increased by 90%, while 70% of cereal production increases resulted from area expansions

(Diao and Nin Pratt, 2005). Even though area expansion by itself is not necessarily bad, it indicates that intensification of smallholder agriculture, which is important to effect durable productivity enhancement, activate the process of commercialization of subsistence agriculture and generate wider growth, is a long way away. Moreover, this expansion of cultivated land is very interesting as the prevailing view is that all arable land has been allocated, and a lack of land for agricultural expansion is causing per capita landholdings to fall to unviable small plots[3].

The recent recovery in grain production has reduced the degree at which the level of national food security deteriorates, a key policy objective. However, it has not been sufficiently high to reverse the negative trend in food security overall. The level of per capita production, for instance, has declined by about 20 kilogrammes between 1979/80 and 2004/5, one of the best agricultural years since the implementation of smallholder intensification program. This decline has been mainly attributed to the high rate of population growth (see Samuel, 2006b). During the past two and half decades, population has almost doubled (it grew by 97%), while production has increased only by 59%, implying a negative growth in per capita production (EEA, 2006).



Despite successes then in boosting production – through both extensification and technology-led intensification – there is no room for complacency in the Ethiopian setting. While debates exist around how national food security figures are calculated, this trend remains alarming if other sources of growth – both farm-based and non-farm – are not increased at rates substantially higher than those achieved by the major government-led PADETES programme.

Farm Income and Poverty

A recent impact assessment study by the EEA found that the recent smallholder intensification programme has slightly enhanced farm income of farmers participating. Even though the study could not control the impact of other variables (other than participation in the program) that could affect farmers performance, the average farmer who participated

[3]The recent experience may indicate the expansion of cultivated land into ecologically fragile areas or forest areas which threaten the sustainability of agriculture.

produced 260 kilogram more grain[4] (equivalent to a net income of Birr 134) than the average non-participant farmer on a single hectare of land (See EEA forthcoming report on Extension Extension). This incremental income, however, will be negative if the cost of land and allowance for market and production risks are considered (see above). There are also confounding variables to consider too. Programme participants were disproportionately 'better off' (though by no means rich) farmers and so had the additional resources, such as draught power, labour, prior exposure to technologies, farming skills, marketing connections etc, to make a return on the adoption of the programme package. Moreover, even for these richer participating farmers, this level of incremental income is low compared to the level recommended by some agricultural economists for sustainable smallholder intensification (i.e. a net return of twice the cost of new inputs), making widespread adoption unlikely on a sustained basis (EEA's forthcoming report on Agricultural Extension).

The study thus points out that the level of improvement is neither sufficient to induce a sustainable input adoption nor to bring any notable changes to the lives of peasants, particularly poorer ones. According to the EEA study, then, if the existing level of productivity and price structure continue, the average grain producing farm household needs 2.8 hectares of land to satisfy the minimum food and non-food consumption requirement of its members and so lead a life above the poverty line, if reliant exclusively on farm related incomes.

Thus if agriculture is to be considered as a growth sector, a reduction in output prices and a rise in farm income should be the ultimate objective of any government intervention in the smallholder sector. This is only possible in a technology-led intensification program that can increase land productivity at sufficiently higher level that can compensate the negative impact of potential reduction in grain prices. Technologically-driven agricultural growth strategies should simultaneously lead to a fall of output prices, while farm incomes increase (Peter Hazell, 2005). This is, however, difficult to achieve in Ethiopia where the current peasant production is structurally poorly adjusted to such conditions. First, the majority of the rural population consists of subsistence farmers who consume a large proportion of what they produce. This in turn hinders the optimal level of market participation required by such interventions, as local demand remains low. Second, the proportion of agricultural and non-agricultural population is highly asymmetrical in the country as a whole with the ratio of producers to consumers about 7 to 1 (Cour, 2003). This affects the structure of the overall agricultural produced market domestically, with millions of smallholders who have no chance to take account of market advantages and must supply what is left from own-consumption to the market simultaneously, resulting in fierce competition among themselves and a lowering of farm prices. Third, the land tenure system is also a problem, as current conditions do not create sufficient space for productive farmers to enter into a

[4] This is a weighted average of different grains. So if the analysis is made by crop types, the picture could be different as some crops like Maize and Wheat have responded to technologies relatively better especially in high potential areas while yield of crops like Teff remains almost stagnant despite the intensification of the program.

dynamic production phase (environment) as the production frontier of most peasants is very limited and highly inflexible because of problems related to the land policy (Samuel, 2006a).

Technological interventions are important but insufficient: Policy and institutional constraints

The level of early improvement resulting from the programme intervention has failed to be sustained both at national level and in higher potential areas, mainly because policy and institutional constraints required for a dynamic and sustainable agricultural intensification were not properly addressed (see section 3 below for further discussion). What the recent intensification programme has demonstrated what could be achieved if existing technologies and recommended practices are properly implemented, rather than what is likely or feasible under existing conditions.

As discussed earlier the average farmer participated in the extension program produced 260 kilograms more grain on a hectare of land than the average non-program farmer. After deducting incremental costs associated with participation in the programme, the net return is reduced to 1.3 quintals (or Birr 134) which is very low, especially considering production and marketing risks which farmers must bear. Moreover, the study indicates that if land cost (which most farmers do not consider as a cost) is considered as a production cost, the net return could be negative (see EEA forthcoming report on Agricultural Extension). This level of financial incentive is very low to induce a sustainable technology/input adoption, even among richer farmers with greater existing resource endowments and ability to respond to risks.

These institutional, economic and policy constraints combined to reduce the level of impact of the recent intensification program. They have also contributed for premature loss of momentum of early promising achievements, and hence affect the sustainability of the programme. Thus these and other findings indicate that technological interventions are not sufficient to address the problem of Ethiopian agriculture. Ethiopian subsistence agriculture fails to play leverage effects on the rest of the economy, unless other non-technological problems of the sector addressed in a comprehensive way. The wider innovation system, encompassing technology delivery, marketing, and wider institutional and policy issues (including land) must be looked at more comprehensively, such studies conclude, if productivity growth in grain staples is to create the wider growth effects in the economy, with advantages for poorer and richer farmers alike. The fact that a farmer needs 2.8 hectares of land for a viable agriculture-based livelihood might indicate the need for well-planned resettlement from some parts of the highlands. While this may only need be a short-term measure to provide time to address key structural problems of the peasant sector that originally created the over-populated, low productive and unsustainable subsistence farming system in the Ethiopian highlands, resettlement and land reform more broadly must be seen, some argue, as part of a portfolio of measures (Devereux et al, 2005)

Land requirements per household would of course fall if farmers had sustained and affordable access to extension and improved technologies, currently hampered by policy and institution

related factors, as discussed. Such productivity increases are possible, but as the evaluations of the government extension programme shows, require more than just the technology package. Reduced land requirements would also result from a growth in the off-farm sector, either in the rural areas or around small towns. Such diversification in trading, agro-processing and service sector provision however must result from the growth linkages emerging from the agricultural sector in the first instance, and this so far is not happening. A wider look at interacting sources of livelihood – from farm and non-farm sources, and the linkages, both positive and negative, between them – is suggested by this review. This requires a more comprehensive and holistic approach to rural development, with agriculture in a variety of guises obviously being a key component. The form this will take is likely to be different depending on the setting, but the broad conclusion has emerged from a number of studies of late including from Wollo (Devereux, et al 2003) and SNNPR (Carswell et al 2000).

As discussed above, agriculture in Ethiopia is characterized by low technology, low productivity and output, heavy reliance on nature and, hence, subjected to natural calamities such as drought and famine. As a result, the majority of the rural population is vulnerable to a persistent and frequent food insecurity threats. Indeed, poverty is pervasive, deep and persistent. Despite huge effort to disseminate technologies (mainly fertilizer and to some extent, improved seeds) to smallholders, the programme has not been supported through a parallel public investment and policy interventions to address non-technological constraints found on the demand side of the same equation. Policy and institutional support are required to enable Ethiopian farmers to harvest what technologies tested at farmers' field and conditions could deliver. The modest impact of the recent smallholder intensification program and the inability of smallholder agriculture to improve the level of national food security and reduce rural poverty reflect partly the failure of policy, policy making process and policy implementation which failed to consider some wider questions in future options and scenarios about sustainable intensification and technology adoption; institutions, financing and market issues; and land and land tenure reform. All interact with each other to answer the question: why has Ethiopia's smallholder sector not intensified despite numerous efforts to encourage technology-led growth over the past decades, and particularly since the mid-1990s. Addressing these interacting constraints is very important to identify future options and scenarios for sustainable, pro-poor growth in the agriculture sector.

3. Future options and scenarios: interlocking constraints analysis

Three interlocking constraints are identified in the following sections based on the empirical data from the Ethiopian highlands and in particular the reflection on the government's intensification package programme, discussed above. Future scenarios for the future of agriculture will have to take account of such constraints, but take account of the trade-offs and implications involved (the subject of section 4 of this paper).

Constraints to technological improvement

The earlier discussion surrounding the 1990s government effort to boost agricultural production through intensification of smallholder agriculture identified many problems that contribute to the loss of momentum or sustainability of initial promising achievements. The programme failed to give due attention to the complex factors and diverse situations influencing agricultural and rural development. The programme could be considered as a 'one-size-fits-all' strategy that failed to recognize variation in terms of agricultural potential (land, soil fertility, water resources) and the limitation of technology oriented intervention to solve the complex and many faceted rural problems of low agricultural productivity, poverty and resource degradation.

That said, technological improvement must play a significant role in the intensification of agriculture in the context of declining size of arable land per person. Advocates of a technology-based intensification of smallholder agriculture argue that interventions should transform small farms from a system dominated by low-productivity, low return and low sustainability in an essentially subsistence oriented farming system to a more productive, profitable and sustainable market-oriented agriculture. Proponents argue that any intervention should meet three but inseparable objectives: high productivity, high return and sustainable use of technologies simultaneously to achieve pro-poor sustainable rural development in the Ethiopian highlands.

However, the Ethiopian highlands consist of a large geographic area with a high variation in growth potential and constraints. Moreover, the country has limited financial, human and physical capital. These situations demand policy makers to classify Ethiopian highlands into some focal areas to enhance the chance of success of rural development programs and utilize efficiently available limited resources. A recent study by the World Bank (2004) confirms that public investment in Ethiopian agriculture has been largely oriented towards low growth potential areas, for social and environmental reasons. According to this study, such a policy apparently has an increasing opportunity cost, including in the lost opportunities for increasing production, income and employment in more favourable zones that need public infrastructure (Hazell, 2005; The World Bank, 2004).

The government's pro-poor intensification programme in the Ethiopian highlands was a general national extension programme that could not create opportunities for smallholders working in different agro-ecology and farming systems to exploit the comparative advantages of their specific area[5]. Along the lines recently recommended by John Pender et al (1999), a sustainable intensification of smallholder agriculture in the Ethiopian highlands could consist of different strategies that includes the following five selected programs based

[5] Recently, the government has expressed its intention to incorporate area based specialization in its agricultural development approach. However, no detail is available on this new approach or its progress.

on area (favourable zones/unfavourable zones), specialization (livestock/agriculture) and capital/labor intensive (large/small farms and irrigation/rainfed agriculture)[6]

These proposed selective agricultural development programs need to be technologically driven so that the chance for output prices to fall while farm income to increase will be high. The reality in the Ethiopian highlands, however, calls for policy and institutional reforms to correct structural problems that include the self-reinforcing subsistence economy, high population pressure, low and declining farm sizes, low urbanization and non-farm employment, high farm fragmentation and tenure insecurity (see below).

Moreover, policy makers should recognize the limitations of government in providing any service required by the smallholder sector. Some argue (e.g. the EEA, 2006) that the private sector should be strengthened especially in marketing of agricultural inputs. The supply driven approach could be appropriate to start with in a subsistence farming system, but to have a sustainable rural transformation demand side constraints, should be addressed in the short to medium term and, in the long-term, demand driven development program should be the ultimate goal of government intervention.

Institutional, financial and market constraints

A sustainable utilization of modern farm inputs (agricultural intensification) is a function of financial incentives to farmers, affordability and availability of modern farm inputs. Moreover, production (environmental) and market risks are affecting sustainable technology adoption in Ethiopian agriculture. Technology promotion among poverty stricken farmers who work under risky environment is a highly challenging activity Technologies should be tested both for their technical performance and economical profitability. Moreover, institutionalized support to risk management and sharing is important especially for smallholders in the Ethiopian highlands where both production (weather) and market risks are high[7].

Small farmers in the Ethiopian highlands should be assured to a minimum reliable level of profit from their use of new technologies. Some agricultural economists recommend a level of profit twice to the cost of new inputs if smallholder input intensification to sustain. However, evidence from recent intensification program in Ethiopia indicates that farmers' participation in the program doesn't guarantee them to this level of recommended financial

[6] The five selective intensification programs could be (i) High External Input Intensification Food Crop Production, (ii) Low External Input Intensification Food Crop Production, (iii) Intensification of Livestock Production, (iv) Commercial Production of Perishable Cash Crops, and (v) High-Value Non-Perishable Perennial Crops.

[7] According to the AFP report, the World Food Program, the UN food agency, signs insurance cover in case of an extreme drought during Ethiopia's 2006 agricultural season at the cost of seven million dollars (Business in Africa Online, 2006). Even though, this is good, priority should be given to those (potential farmers in potential areas) who did not use technologies or use them at suboptimal level in fear of drought or market risks.

profitability[8]. Input profitability analysis, therefore, should be a necessary early step in developing and sustaining successful input promotion and market development program. Policy makers should give equal emphasis to incentives and affordability of modern inputs as their efforts to ensure availability of technologies (fertilizers and improved seeds, to some extent). Farm technologies and technical recommendations should also subject to policy analysis to identify the type and level of non-technical interventions required for a sustainable and profitable use of technologies in future intensification programs.

Among the policy interventions that need the attention of policy makers include targeted insurance and/or subsidies. Small and subsistence farmers in highly potentially but inaccessible areas need market support and insurance against price risks (market insurance). A different type of risk (weather or rainfall risk) is essential for farmers willing to use weather-sensitive technologies in less favoured or less potential areas. Such kinds of interventions will not only help for sustainable intensification of smallholder agriculture but also strengthen the impact of technology intensification on poverty reduction.

A well-functioning agricultural market is an important element of agricultural development program. It could enable farmers' to get a fair proportion of consumers' price, enhance farm income and, consequently, allow the process agricultural intensification to deepen further with a positive impact on poverty reduction. However, agricultural output markets in Ethiopia are highly fragmented and operate in highly uncompetitive environment that leads to high temporal and spatial fluctuation in grain prices. On the other hand, small grain farmers have low capacity to keep their output and sell at a time that offers better price. A recent study by the Ethiopian Economic Association indicates that 77% of the farmers who store grain sell it in about a month time, and 26% reported that they had no surplus to store (see EEA, forthcoming report). Gebremeskel et al, (1998) also confirm that about 79% of farmers' annual grain sales occur immediately after harvest season – January to march – because of fear of storage loss and in order to fill their immediate cash needs Because of weak effective demand and market fragmentation, farmers' receive the lowest price for their products during this period. Cash need to pay back credit was reported as the major factor for selling grains at times when prices are the lowest. Farmers also face high storage loss if they store their products for a long time.

In a real sense what matters most to peasants is not the level of farm prices, but its purchasing power vis-à-vis prices for basic commodities and farm inputs. Studies indicate that peasants are not only bothered by the problem of high seasonal fluctuation of farm prices but also by a decline in the purchasing power of agricultural prices. In its second annual

[8] The study indicates that the level of financial return from participating in the program is not only fairly small but the modest return attributed to participation could be turn into loss if the exercise consider the cost of land (which most farmers' don't consider as cost under current Ethiopian condition), and allowance for market and production risks (for details, see EEA's forthcoming Report on Extension Study, 2005).

report, the EEA indicate that the price index for food/agricultural products[9] increased only by 14.6% over the five years from 1995/96 to 2000/01, while the corresponding price index for DAP fertilizer and transport/communications grew by 37.5% and 66.1%, respectively. During the same period, farm-gate (farmers' price) for 100 kilogrammes of wheat, teff and maize declined by 70%, 63% and 52%, respectively, when compared to the price of 100 kilogramme of DAP fertilizer (EEA, 2002).

The terms of trade between the agriculture and non-agricultural sector during the implementation of the programme was, therefore, substantially against agriculture[10]. Under normal conditions, this price trend is not a problem; rather it could signify a positive situation as it indicates that the agricultural sector has been playing its growth role by allowing resource transfer to the non-farm sectors[11]. However, this is not the case in Ethiopia, as the corresponding increase in grain yield is not sufficiently high to compensate the decline in farm prices or the increase in non-farm prices.

What worsens the negative impact of this low level and relative decline in agricultural prices is that it has been happening in an environment where agricultural labour productivity continues to decline, mainly due to high population growth (high labour-land ratio), low migration, decline in average farm size and meagre rises in yield. These factors may contribute to premature (untimely) resource flow away from the smallholder sector that perpetuate rural poverty. Institutional and market problems that distort the terms of trade against farmers could hold back the entire economy, not just agriculture.

It was only after the 2001 grain price collapse when the price of 100 kilogrammes maize fell as low as 20 Birr (about 2.5 USD) that the government intervened in agricultural output markets[12]. The government set up an institution led by a State Minister to look after agricultural markets and promised to introduce a system that can guarantee smallholders a minimum price for major grains (like maize and wheat) which got the highest attention by

[9] Rural prices for cereals, pulses, oilseeds and vegetables and fruits were considered in the computation of agricultural food price indexes.

[10] Some other studies also confirm this result. A study by Abdurahman, for example, indicates that the terms of trade is moving against the agricultural sector in general and food production in particular since the reform program (Abdurahman, 1995).

[11] If low producer price translates to low consumer price, the advantage of declined food price could contribute to the growth of the economy (at the expense of small farmers) indirectly through its positive effect of enhancing consumer expenditures on non-farm products. But this is not the case because of high transaction costs due to poor market integration and uncompetitiveness.

[12] The 2001 total price collapse was not the only a warning sign to policy makers. It also reminded them that their decision to withdraw hastily and quickly from agricultural output markets in the early 1990s as part of the liberalisation package was mistaken. Instead of strengthening the then Agricultural Market Corporation (AMC) by correcting its deficiencies such as improving its price that had been fixed very low when compared to the price at free markets, the government opted to destroy the AMC and dismantle its market infrastructure that found across the country. Here the issue is not allowing farmers to sell their products to free market rather than to government market centers that usually set prices very low. But the process had exposed peasants to highly risky market environment and devoid them to get institutional support that could bear or share market risks with them.

the intensification program. However, little has been done since then in terms of introducing a price policy or other market related reforms including the warehouse system that will allow smallholders to determine the time of sale of their produce and, consequently, improve farmers' chance to receive high price and reduce crop loss due to traditional methods of crop storage. Similarly, the attention given to the formation of farmers organizations (e.g. commodity associations, cooperatives, and saving and loan organizations) which, among others, could allow smallholders to realize the benefit of economic scale in marketing is very low. Instead of a formally adopted transparent policy, the government opted for some ad hoc interventions in the grain market primarily through the Ethiopian Grain Trade Enterprise. Policy makers have also encouraged donors to purchase grains locally to distribute as food aid in food insecure areas.

Another challenge for sustainable smallholder intensification is poor opportunities of peasants to finance short- and long-term farm investments. The problem is both on the supply and demand sides. On the supply side, the country lacks financial institutions (institutions that provide credit, saving facilities and insurance markets) to deal with the need of the smallholder sector[13]. Rural financial institutions should be more flexible and recognize the high uninsured risks that farmers face[14]. Alternatively, insurance schemes such as weather insurance (which are heard as being piloted in Ethiopia) could be promoted to help farmers to manage agricultural risk. High level poverty and lack of feasible investment alternatives are also hinder the demand both for short and long-term farm investments. Studies indicate that smallholders face difficulties in satisfying their consumption needs, let alone financing their farm expenditures. A recent study by the EEA, for instance, indicates that average household income from farm and non-farm activities satisfies only 59% of basic food and non-food needs of the average smallholder farmer (see EEA forthcoming report on Extension Study). The level of challenge smallholders' face in financing any farm technologies from their own resources is thus huge. Currently, both farmers and agriculture-related small and medium enterprises have considerable difficulties in accessing to long-term credit, but lack of effective demand for available finance due to lack of opportunities for its profitable use is also reported as a major problem (EEA, 2006).

Rural financing activities in Ethiopia have mainly concentrated on short-term fertilizer credit and to some extent to pity trade and consumption smoothing purposes, mainly through micro-finance institutions. The government has considered fertilizers as a strategic input to ensure national food security and, consequently, has taken policy measures to ensure its wider use. It subsidized fertilizer until 1997 when it abandoned subsidies mainly because of pressure from international financial institutions. Since then, the government has expended

[13] With the exception of the fertilizer credit which operates well as regional governments guarantee (from their budget) banks to repay debts if smallholders failed to repay their credit. The question remains how sustainable will be such arrangement as it is not correct to pay public funds for some individuals and violates the concept of collateral.

[14] Farmers who defaulted on loans were sometimes imprisoned irrespective of the factors that lead them to fail to pay their loan.

its fertilizer credit substantially to encourage its use and minimize the negative effect of subsidy withdrawal. Mulat (1999) indicates that over 80% of farmers buy fertilizer on credit. But low levels of productivity and land shortage coupled with marketing problems constrain a sustained profitable use of farm credit. Inflexible credit repayment procedures are also widely reported as hindering smallholders' interest in farm credit (Carswell et al, 2000).

Agricultural credit, many argue, should not only be available to finance short-term farm expenditures but also long-term investment activities cutting across different livelihood domains, both on- and off-farm. Smallholders need access to credit for long-term land improvement and capital expenditures that include expenditure for irrigation facilities, farm machinery and post-harvest technologies, as well as to meet short-term seasonal needs. Private rural-based and small-town businesses could also be encouraged and supported to engage in the processing of agricultural products and in transport and input-supply operations through providing the required credit for long-term investment and working capital which will also strengthen the efficiency of the smallholder sector. However, medium to long-term investment finance is non-existent in most rural areas due to structural problems in the rural sector, including issues related to the land policy like lack of collateral and the smallness of farm sizes.

Across these issues, policy makers should recognize the limitations of government in providing any service required by the smallholder sector. Some argue (EEA, 2006), the private sector should be strengthened especially in marketing of agricultural inputs. The supply driven approach of the government could be appropriate to start with in a subsistence farming system, but to have a sustainable rural transformation demand side constraints should be addressed in the short to medium term and, in the long-term, demand driven development program should be the ultimate goal of government intervention.

Land and tenure constraints

Land is the most extensively used factor of production in the Ethiopian subsistence agriculture. However, the supply of productive land and its efficient utilization has been increasingly constrained by increased population pressure, and by lack of sufficient soil moisture and inadequate utilization of land-saving farm technologies, respectively. Smallholder agriculture lacks an adequate capacity to replace nutrients mined from agricultural lands through crop production, or fail to counterbalance the negative impact of high population growth. The only unsustainable alternative at peasants' disposal has been to expand agricultural activities even to forest and other ecologically fragile areas at the expense of future uses and generations. This problem has been compounded by state ownership of land and forest resources.

Land in Ethiopia is a public property that has been administered by the government for more than three decades (see Samuel 2006a). Farmers have open-ended (vague) use rights to agricultural land and restricted right to transfer or lease their use right. Thus, land tenure systems under the existing public ownership of land derive from official allocation by local

government authorities and/or through transfer of land use rights. The major types of tenure systems of agricultural land include own-holding resulting from inheritance and/or official land allocation, cash renting and sharecropping.

One of the policy instruments to halt the undesirable relationship between small farmers and nature in Ethiopia is, many commentators argue, the lack of an appropriate land tenure system. Tenure security is an important factor that affects technology choice and utilization by small holders. In many countries of the developing world, insecure land tenure prevents large parts of the population from realizing economic and non-economic benefits that are normally associated with secure property rights in land. These include greater investment incentives, transferability of land, improved access to long-term credit, more sustainable management of resources and independence from discretionary interference by bureaucrats. These imperfections in the land policy and administration assumed to undermine the value of land and consequently discourage intensification and long-term investments on land improvements (Deininger et al, 2003).

Smallholder agriculture in Ethiopia is not only facing tenure insecurity problem which the government has been struggling to address recently, but also declining farm size and high farm fragmentation, which again is partly attributed to the existing land policy. Agriculture is predominantly smallholder agriculture where over 85% of farmers cultivate farms less than 2 hectare. In 2000 cropping season, more than 87% of rural households operated farms less than 2 hectares; 64.5% of the total rural households operated less than one hectare; while 40.6 % operated farms of 0.5 hectare and less (CSA, 2002; Workenh, 2005). Such small sizes of farms are fragmented on average into 2.3 plots. About 11% of farmers were reported to be landless in 2002 (EEA, 2002).

A recent study carried out by IFPRI has found that the major constraint to food security especially in food deficit areas where more than Ethiopia's 25 million people reside is extremely small farmland (0.57 ha compared to1.38 ha in food surplus areas)[15]. Of the 184 *woredas* constituting the food deficit area, per household farmland is less than 0.4 hectare in half of them and less than 0.3 hectare in one-third of them (Diao and Nin Pratt, 2005). The negative impact of minuscule farm sizes is also reflected by low land productivity. Diao and Nin Pratt (2005) indicate that the average cereal yield is about 1 metric ton per hectare, 20% below the national average, on food deficit areas where the average farm size is less than 0.6 hectare. Similarly, return from the use of modern inputs is also low in these areas (0.2 ton less per hectare when compared to food surplus areas) (1.24 ton versus 1.44 ton)

In general, the average farm size in most parts of Ethiopia is so low that finding ways to pull these small farmers out of poverty constitutes a formidable challenge. The problem with very

[15] The study narrowly defined food deficit weredas as weredas with cereal equivalent output per rural household at levels of 20% less than the national average, food balanced weredas are those with cereal equivalent output per rural household at levels 80-120% of the national average, and surplus area those with cereal equivalent above 20% of the national average.

small farm size is further compounded by low productivity, high population pressure and lack of employment in the non-farm sectors. All these aggravate the incidence of rural poverty. According to a recent study by the Ethiopian Economic Association, an average farmer who cultivate farms between 0.90 and 1.22 hectares of land could satisfy only about half of the minimum consumption requirement of his/her households, respectively[16], if reliant solely on agriculture (see above;EEA, 2005, Extension study). The contraction of farm size per household has reached a stage that demands a concerted search for ways 'viable' farm sizes and/or technologies like irrigation which can enable existing farms to support the livelihoods of more people, alongside a realistic debate about the meaning of 'viability' and 'economic farm size' in the context of the multiple livelihood systems in Ethiopia

The issue of declining farm size, however, does not catch sufficient attention in Ethiopia. Policy makers usually make an erroneous comparison of the Ethiopian situation with countries like China. It is true that the average farm size in Ethiopia is well above the average size in China. However, labour productivity (i.e. the return to labour from a unit of land) is more important in relation to impacts on poverty than the actual size of land cultivated by a farmer. In terms of farm labour productivity the situation in the two countries is not comparable. Therefore, a one-sided comparison might mislead and undermine the level of attention given to the issue in Ethiopia. Samuel (2006a) discusses some of the options and scenarios emerging in the land debate in Ethiopia, including maintaining the status quo, investing in more efficient land markets, land privatization and titling and improving tenure security through land registration and certification.

4. Future options and scenarios – four overlapping trajectories for Ethiopia

To draw relevant lessons for Ethiopia, the World Bank Country Department for Ethiopia has recently undertaken a case study of agriculture-based growth strategies covering the experiences of Morocco, China and Chile (World Bank 2004). Despite their differences in agricultural development pathways, the experience drawn confirms that a successful rural development strategy must involve a sequence of programmes and policies, built on a clear understanding of two major issues: selectivity and market orientation. The selectivity issue refers to the degree of concentration of public investment on selected programmes (favourable zones/unfavourable zones, livestock/agriculture, large farms/small farmers) versus general programmes (national level extension, research, credit, input support). The market orientation issue refers to the degree of export and import substitution/promotion included as an incentive to producers. Some common but key elements necessary for success anywhere include, according to Pender (2000): peace and security, macroeconomic stability and a competitive market environment.

[16] This is in sharp contrast to countries like China where farmers own on an average about 0.6 hectare of land but produce much more surplus for the market. Therefore, some comparison made by some policy makers on the average farm size in China and Ethiopia is a partial and incomplete comparison that could lead to wrong conclusion. In other words, any comparison of farm size should also consider the production aspect of the story beyond the physical dimension of the resource.

While some of these more general factors can be taken as a given for Ethiopia, some of the more context-specific questions raised by the World Bank study are not known for the country. General diagnosis, based largely on survey material from the northern highlands, may not be reflective of the rest of the country, for example. What might a strategy look like in the root crop/enset zone of the south, where productivity enhancement is more challenging? What is special about the constraints set of dryland and pastoral areas and what might encourage pro-poor growth in such areas? What about the lowland irrigated areas where potentials for large-scale cash production is evident with the right investment and policy? And what about new high-value flori- and horticultural investments, how significant are these in a pro-poor growth strategy?

There are of course many more questions to be asked about future scenarios of agricultural intensification, but, following Devereux et al (2005) a series of four possible generic scenarios can be identified from the above discussion, each subject to different constraint sets and interactions between these. For crop production (largely in the highlands where livelihood vulnerability is most acute, some different scenarios and implications of these are evident.

Intensification: More supply side, technology driven support to growth in grain staples in smallholder agriculture as part of a more strategically focused innovation systems approach. Learning the lessons from past experience, this would have to involve better targeting according to types of farmer and agricultural potential (or/and agroecological zone). Overall the strategy may have to choose between different routes, with focus either on high potential area/high resource endowment farmers, or with an immediate term poverty reduction focus and potentially higher marginal returns (if not overall returns), or a focus on low potential areas/low resource endowment farmers (or some combination). Such technology packages would have to encompass a wider remit than just the technology and its delivery, to include market, institutional, governance and other issues as part of a strategic 'innovation systems' approach focused on grain staples

Commercialisation: Liberalisation of markets and the active encouragement of the private sector to seek out commercially profitable enterprises to generate growth. Such a strategy focused on market determined criteria might be enhanced through a greater liberalisation of markets, allowing private sectors to enter on an equal footing to government-run or quasi-private state enterprises. Such deregulation and liberalisation could go together with focused public investment in infrastructure (roads, water supplies) etc., to make such privately run enterprises more attractive. Finance and credit facilities could be improved significantly to enhance private entrepreneurship at small and large scales. The issue here would not be a question of smallness or largeness but of simple profitability. Without prejudice (and this would have to include the liberalisation of land markets) different sized operations would be encouraged. Attention may be given to facilitating growth linkages, but in general a trickle-down effect would be expected under this scenario with an overall positive impact on agricultural growth having wider benefits beyond the enterprises concerned. Taxation and redistribution for social protection purposes may have to be considered as a complementary

policy measure in time, but probably not initially as investment needs to be maximally attractive to either local domestic or foreign or joint venture concerns.

Depopulation and land consolidation. In order to make new enterprises commercially 'viable' or at least to sustain more people on the land with income substantially or all from agriculture will require a significant depopulation of highland areas, with a parallel process of land consolidation. This needs to be facilitated by resettlement processes, both to new agricultural land in underutilised areas, and also through rural-urban migration, including to small towns and business centres. While voluntary rural to rural resettlement is a component of policy, the extent of depopulation is limited by restrictions on other migration routes, especially across regional state boundaries. For a large-scale and voluntary movement of people out of over-crowded areas and consolidation of small fragmented micro-plots into ones that have a chance of intensification will require a combination of such measures implemented in concert.

Livelihood diversification. To avoid movement out of agriculture into destitution, a number of pull factors need to be in place, including incentives to diversify both locally and in towns into non-farm, but agriculture-linked activities. With the focus on the single productive farm this sort of mixed livelihood strategy requiring smaller areas and different support structures has been off the agenda in Ethiopia, but is a critical component of any future, according to this scenario (and may result in less depopulation required than the Malthusian fatalists). At different stages of agricultural growth in any area, what are the livelihood diversification options that have the most growth linkages with agriculture, are the most compatible with sustaining a part-time agricultural base, and are sensible to foster given current market demand and institutional conditions pertaining. While there has been much work discussing diversification strategies (see above), see diversification as part of an agricultural growth strategy has seen less prominence in the Ethiopian debate. This scenario is not based on a false and misleading dichotomy between agriculture and diversification or on assumptions of de-agrarianisation, but on the important interaction between the farm and non-farm sector which requires a more integrated, holistic approach to rural development and livelihoods than currently on offer.

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Across these scenarios debate needs to take place at a local and regional level, taking account of the diverse livelihood strategies in existence today. New scenarios supported by technology, market, institutional and other interventions must be compatible with existing pathways of change, and not impose unreasonable expectations on highly constrained settings. The interlocking constraints set identified in the previous section clearly have different contours in different places, and is pertinent to different groups of people. Looking at context specific options and constraints through stakeholder involvement in a series of workshops across different parts of Ethiopia is a central part of the next phase of the Agriculture Futures Consortium work. This paper will provide general background for these discussions, and will be an important baseline against which to test constraints and scenarios as they emerge in different settings, settings which go beyond the northern highland conditions to other production systems and sites.

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